CHAPTER 1

INTRODUCTION

1-1. Purpose. This manual provides guidance on effective and economical selection, evaluation, and use of large-stone materials in construction. The manual is intended particularly for Corps of Engineers (CE) personnel in engineering or construction divisions. The manual also serves as a supplement to guidance on engineering design of large-stone features and structures available among references.

1-2. Applicability. This manual is applicable to major subordinate commands, districts, laboratories, and field-operating activities (FOA) having civil works responsibilities.

1-3. References. Applicable references, annotated as items, are listed in Appendix A.

1-4. Definitions. Several terms are defined here to minimize confusion from the widespread ambiguity existing in current practice. These definitions are not necessarily applicable beyond this manual. The usefulness of these terms within the manual implies that special care may be needed whenever large stone is described formally in a design memorandum or a construction contract.

a. Riprap, armor, D zone, and protection stone are used in reference to engineered features composed of large-stone materials. Simplest terminology for rubble mounds distinguishes armor and core stone with an underlayer of intermediate stone size commonly sandwiched between. In slope protection, riprap is often placed on a bedding layer of less than large-stone sizes.

b. Jetty stone and cap stone refer to stone of very large size for special engineered features or structures or portions thereof.

c. Rock, stone, field stone, and rubble are used in reference to granular or particulate construction material. Rock or stone can also mean an individual element (for example, one block or boulder) of such a composite material. Stone has been defined occasionally as a construction material, in distinction from rock still located naturally in place. Such distinction is not widely made and is rejected here in favor of a general equivalence. Where judged to be beneficial, separate terms should be carefully defined and consistent.

d. Cut stone, dimension stone, and derrick stone refer to stone with special shape or size resulting from the method of production.

e. Aggregate is a granular, stone construction material mostly used in concrete and distinguished from large-stone materials by its smaller stone sizes.

f. Large-stone refers to the size of granular construction materials generally coarser than aggregate, that is, averaging 3 in. or greater. Protection stone or armor is about equivalent but has the added connotation of the use in protecting a slope or structure.

g. Ledge rock and sometimes rock and field stone refer to rock in situ within a quarry or other possible source.

1-5. Scope. The scope of this manual has been made broad, ranging through subjects as diverse as geology and technically based construction contracting. Chapter 2 reviews the wide spectrum of engineering applications of large stone. Chapter 3 reviews potential problems in using large stone and is based on past CE experience. Chapters 4, 5, and 6 explain good practice in evaluating materials and sources of materials. Chapters 7 and 8 summarize pertinent aspects of contracts and construction. Since these efforts are accomplished by contractors and suppliers, the CE perspective emphasizes quality assurance.

1-6. Exclusions. Certain exclusions are important to recognize in this manual. First, the subject of rock aggregate is omitted except for peripherally important aspects such as the application of aggregate test methods to the evaluation of large stone. Second, and of considerable importance, is the fact that guidance on design procedures using large stone is omitted from this manual. Guidance on design of various structures is available in other engineer manuals (Figure 1-1).

1-7. Use of Manual. Figure 1-1 shows schematically how this manual can be used in coordination with guidance on design of an engineered feature or structure such as a harbor breakwater or a zoned rockfill dam. The need for this special supplemental guidance arises from the variability of the natural material being used and the substantial impact this variability can have on the project. Each generic rock type and the sizes of stone produced from it vary from region to region and quarry to quarry. Variations exist even within a quarry, a single ledge, or a stockpile. This manual guides the user in recognizing and adjusting for these complications in efforts to plan and design the project cost-effectively and, ultimately, to complete the construction as designed.

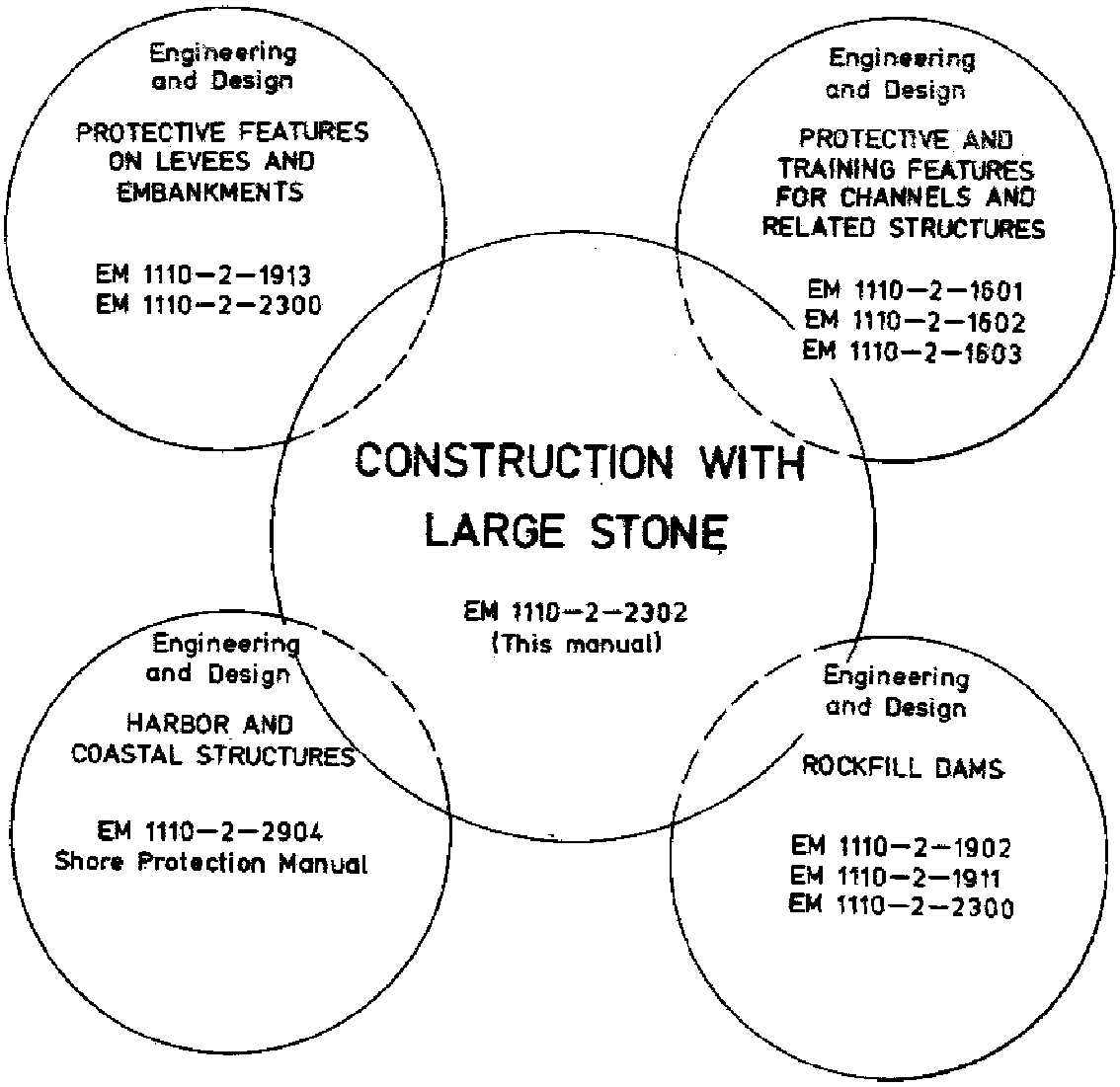

Figure 1-1. Relation of this manual to guidance on design of large-stone structures